Development Issues

Sources of welfare gains and losses in forming a preferential trade area

Yongzheng Yang
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Key to symbols used in tables
  n.a.  Not applicable
  ..  Not available
  -  Zero
  .  Insignificant

Yongzheng Yang is a Research Fellow in the Economics of Development at the National Centre for Development Studies, The Australian National University.
abbreviations

CDE
CGE computable general equilibrium (model)
FTA free trade area
GDP gross domestic product
MFN most favoured nation
NAFTA North American Free Trade Area
PTA preferential trade area
ROW rest of world
USC United States and Canada
Abstract

The conventional approach to the welfare analysis of preferential trade areas (PTAs) often focuses exclusively on the import side and ignores the export side. Together with the homogenous product assumption, this tends to bias the assessment of the terms of trade impact of PTAs and omit their general equilibrium effect. In this paper, the GTAP global general equilibrium model is used to address these shortcomings. Decomposition is undertaken to reveal the sources of welfare changes. By taking advantage of the rich details of economic structure and trade policy underlying the model, this approach to the analysis of PTAs provides some useful insights into the determinants of their welfare effects, including potentially important second-best outcomes.
Sources of welfare gains and losses in forming preferential trade area

Introduction

The proliferation of preferential trade areas (PTAs) has generated considerable interest in the evaluation of their welfare impacts. Much of the research has focused on the effect of imports on member countries. It is generally accepted that the expansion of exports to the partner countries as a result of the formation of a PTA is welfare-improving, while the effect of the expansion of imports from partner countries is not clear-cut.

This ambiguity on the import side is essentially a second-best problem. In forming a PTA, member countries agree to reduce or eliminate tariffs against each other, but they are not obliged to do the same to third countries. Thus, tariff reductions for imports from partner countries without reductions in tariffs on imports from third countries can lead to trade diversion as well as trade creation. Trade diversion occurs when increased imports from partner countries reduce inefficient domestic production rather than replace imports from third countries. Trade creation occurs when a PTA simply switches imports from third countries to partner countries, without replacing inefficient domestic production.

The theoretical evaluation of PTAs has been dominated by the partial equilibrium approach. The impact of increased imports on the domestic economy is typically the focus of such an approach, and the impact of resulting changes in exports is often ignored. This approach implicitly assumes that the export supply curve is perfectly elastic. Therefore, changes in exports do not have any welfare implications. In the real world, export prices do change following trade liberalisation, especially those of trading partners. Although this export side issue has been increasingly recognised (Wonnacott and Wonnacott 1981; Richardson 1995; Grossman and Helpman 1995; Hossain and Vousden 1997), it has seldom
addressed in a general equilibrium framework. When the general equilibrium analysis of a PTA is used, it is often undertaken with strict assumptions about functional forms and the number of products and countries. Simulations are resorted to when the analysis becomes intractable.

In the conventional analysis of PTAs homogenous products are often assumed. This tends to neglect the impact of a PTA on the cost of domestic production, and hence the possible positive effect on the importing country’s cost competitiveness. In the homogenous product framework, when imports from the PTA partner increase, they merely replace some of the imports from the rest of the world, unless the rest of the world can be completely swept out of the home country market.

This paper addresses the issue of the welfare impact of PTAs within an applied general equilibrium model context. This approach can overcome the shortcomings of the partial equilibrium analysis by taking into account all effects of a PTA, including its impact on exports, incomes and imports. It also enables us to evaluate fully any terms of trade effect within a framework of differentiated products. The sources of this effect can be traced and its magnitude can be examined. Using this type of model also requires less restrictive assumptions about consumption preferences and production technology than other models.

The paper is organised as follows. In the next section, I review the conventional partial equilibrium analysis of PTAs and identify the critical issues that need to be taken into account in the welfare analysis of PTAs. In the following section I discuss how the GTAP global computable general equilibrium (CGE) model is used to simulate the welfare effects of a PTA. The simulation results on the incidence of gains and losses arising from a PTA are then reported and analysed and the robustness of the simulation results discussed. The main findings of the paper are summarised in the concluding section.

Conventional analysis and its limitations

Conventional analysis of PTAs rests on the pioneering works by Viner (1950), Meade (1955) and Lipsey (1960). The concepts of trade creation and trade diversion are central to the analysis. Such analysis typically relies on the homogenous product assumption, as this makes the analysis more tractable in two-dimensional diagrammatic presentations (Figure 1). Suppose that $D_H$ is the excess demand curve of the home country, $S_P$ is the excess supply curve of the partner country, and $S_R$ is the excess supply curve of the rest of the world. Note that all the curves here represent excess demand or supply, implying that they are the relationships between net trade and prices. A homogenous product is therefore assumed in the diagram. Typically, it is assumed that the rest of the world’s (ROW) excess supply curve is more elastic than the partner country’s excess supply curve, as a PTA normally excludes most countries in the world, even though some PTA participants may be quite large relative to the rest of the world. For simplicity, we assume that the ROW excess supply curve is infinitely elastic.
Suppose that before the formation of the PTA, the home country maintains a most favoured nation (MFN) specific tariff, $T$, on imports from both the partner country and the rest of the world. Suppose also that a market equilibrium is established at the domestic market price, $P_m$, which is the border price $P_w$ plus the tariff. At this price, imports from the partner country by the home country are $OQ_1$, those from the rest of the world are $Q_1Q_3$, and total imports are the sum of the imports from the two sources, $OQ_3$. The welfare level for the home country as measured by consumer surplus and tariff revenue is represented by areas $AEB$ and $BEIF$.

Now assume that the home country eliminates the tariff on the imports from the partner country, but continues to maintain it for imports from the rest of the world. As a result, the imports from the partner country increase from $OQ_1$ to $OQ_2$, and the imports from the rest of the world decrease from $Q_1Q_3$ to $Q_2Q_3$. Total imports do not change, since the domestic price does not change. However, tariff revenue falls by an amount represented by area $BDHF$, which the home country would collect on the partner country if there was no PTA. Note that there is only trade diversion; there is no trade creation as total imports and
the domestic price remain unchanged. Clearly, the higher the initial MFN tariff and the more elastic the partner country’s supply, the larger is the tariff revenue loss. On the other hand, the partner country gains as its producer surplus increases by an amount represented by the area $BDGF$. This is essentially the analysis of Bhagwati and Panagariya (1997). They conclude that the home country is likely to lose from a PTA unless it is small relative to the partner country and large relative to the rest of the world.

It should also be noted that the PTA countries as a whole also lose, by the area $DHG$, which arises from the increase in inefficient production in the partner country following the diversion of imports from the rest of the world to the partner country. Within the assumptions adopted, there is little chance that a PTA will be welfare-improving for its participants as a whole. Moreover, if it is not assumed that the rest of the world has a perfectly elastic excess supply curve, the rest of the world would stand to lose as well, as its producer surplus would be reduced as a result of trade diversion.

How realistic is such an analysis? At least two things can be added to this analysis in order to make it more realistic: product differentiation and general equilibrium effects.

Suppose that each of the three economies involved produces a differentiated product. Let’s first deal with the impact of the PTA on the import side in the home country. In Figure 2, the upper panel shows the market for imports from the partner country, and the lower panel shows the market for imports from the rest of the world.

Similar to the earlier analysis, suppose that before the PTA the home country initially maintains an MFN tariff on imports from both the partner country and the rest of the world. It should be noted that under the differentiated product assumption, the supply curves of the partner country and the rest of the world are always upward-sloping, even if the home country is small relative to the partner country and the rest of the world. Given the demand and supply curves for the two products, the quantity demanded and supplied of the partner country product is $Q_{P0}$ and the corresponding domestic price in the home country is $P_{P0}$. The two corresponding variables in the ROW product market are $Q_{R0}$ and $P_{R0}$. The corresponding supply prices that the partner country and the ROW receive are $P_{P0}'$ and $P_{R0}'$, respectively. Thus, before the PTA, the welfare level for the home country derived from the partner country product market can be represented by the sum of areas 1, 2, and 3.

Now suppose that imports from the partner country are exempted from the tariff in the home country because of the PTA. Imports increase from $Q_{P0}$ to $Q_{P1}$ and the domestic price facing the home country consumers declines to $P_{P1}$. The welfare for the home country in this market is now the sum of areas 1, 2, and 5. Whether this sum is larger than the pre-PTA welfare level depends on the relative size of areas 3 and 5. The more elastic the supply of the partner country, the more likely the home country gains, as the adverse terms of trade effect diminishes. Thus, a small home country is more likely to gain. The partner country gains by areas 3 and 6.
Figure 2  An analysis of a PTA in a differential product framework

(a) The partner country product market

(b) The ROW product market
As the tariff on imports from the partner country is eliminated, there are at least three other important effects. These are the effects on the demand for the rest of the world’s product, the income of the home country and the export of the home country product. Let’s examine them one by one.

Since the partner country product is an imperfect substitute for the ROW product, the demand for the ROW product in the home country would shift to the left as the tariff on the partner country product is eliminated. Unlike in the homogenous product case, however, the reduction in imports from the rest of the world is not necessarily the same as the increase in imports from the partner country. As can be seen in the lower panel of Figure 2, the rest of the world unambiguously loses in this market. Whether the home country will gain is not clear. Before the PTA, the welfare level for the home country is represented by the area ABFD. The post-PTA level of welfare is HIJK. Whether ABFD will be greater than HIJK depends on the supply elasticity of the ROW. The more elastic the ROW supply is, the more likely the home country is to lose, as the favourable terms of trade effect represented by area 4 diminishes. Given the ROW is normally large relative to any individual PTA member countries, it is likely that a small home country would lose in the ROW product market.

In the homogenous product framework, the domestic price in the home country normally does not change following the PTA. In contrast, in the differentiated product framework, the domestic prices of imports from both the partner country and the ROW will fall in the home country. This leads to an important secondary impact in the home country. If imports are used as inputs in domestic production, this will reduce domestic production costs and hence shift the home country’s supply curve downward. The resulting lower price for the domestic product benefits domestic consumers if it is sold in the domestic market, or improves the home country’s competitiveness in the overseas market, if the product is sold in the export market.

Such export expansion is re-enforced by reciprocal tariff reduction in the partner country, and this effect is often overlooked in the conventional welfare analysis of PTAs. The gain in the export market for the home country can more than offset the possible loss in the domestic market. While increased imports from the partner country often lead to an increase in their costs, export expansion resulting from the reciprocal tariff cut by the partner country generally leads to an improvement in the export prices for the home country. This is especially true if the home country is small relative to the partner country.

If the overall impact of the PTA on the home country is positive, there is an income effect which will lead to greater demand for all normal goods. Such an income effect is normally smaller than the direct price effect, but for a small open economy, this effect can be significant.

An important conclusion one would draw from the above analysis is that once general equilibrium effects are taken into account there is no clear-cut answer to the welfare effect of the PTA on the participating countries, although the rest of the world is likely to lose. Much depends on the initial level of the tariff and the extent of its reduction, the
relative size of the economies involved, and the ease with which products from different
countries can substitute for one another. In the real world, the issue is further complicated
by the existence of a vast number of commodities produced and traded by all countries
involved. A country may benefit from a PTA in one product but lose from another. Thus,
the evaluation of the welfare effect of PTAs is an empirical question.

Modelling the welfare effect of a PTA

Section 2 showed the difficulties of evaluating the welfare impacts of a PTA using analytical
models. In this section I discuss how the GTAP global general equilibrium model is used in
this paper for analysing the welfare effects of a PTA. A 3x3 version of the GTAP model is
used. The three regions are the United States and Canada (USC), Mexico, and the rest of the
world (ROW). Our simulation analysis focuses on the North American Free Trade Area
(NAFTA). The three commodities are food, manufactures and services. This small model
size is intended to facilitate the interpretation of simulation results and sensitivity analysis.

There are several reasons why the GTAP model was chosen. First, the model and its
database are well-known and transparent. Second, the GTAP database allows tailored
disaggregation of regions and commodities. Our analysis in the previous section showed
the importance of country size in determining the welfare outcome of a PTA. The three
regions chosen have the desirable country size for analysis: a small developing region, a
large developed region and an even larger rest of the world. Third, although we are not
interested in any particular PTA, the NAFTA provides a real-life example of a PTA and has
generated substantial research interest. Finally, the GTAP model is based on neoclassical
economic theory. It assumes constant returns to scale and perfect competition but
incorporates product differentiation by place of production (Armington 1969). This allows
us to use established trade theory to guide our interpretation of simulation results.

The details of the GTAP model can be found in Hertel (1997). Here we focus on the
model closure for our simulations in an attempt to put the results in the broad context of
micro and macroeconomic assumptions. In all simulations undertaken in this study, all
prices and quantities are endogenously determined except for the price of savings—the
numeraire. Thus, any price changes in the simulations are relative to the price of savings.
Land, labour and capital are all exogenous. Labour and capital are perfectly mobile across
sectors while land is only mobile across agricultural sectors. This means that expanding
sectors can easily draw labour and capital away from contracting sectors. The elasticity of
transformation between sectoral land uses is unity. Because GTAP is a one-period model,
investment does not augment productive capital stock in the current period, although it
affects final demand. For this reason, capital stock is exogenously augmented in projection
simulations and is fixed in comparative static simulations. While savings are a fixed share of
income, investment is determined by its expected rate of return. In the simulations we
assume limited capital mobility, so that the rate of return to investment changes at varying
rates across regions and regional investment changes at the same (global) rate. This
effectively prevents any large changes in the trade balance as changes in regional savings and investment tend to be small in comparative static experiments.

The particular measure used to evaluate the welfare effects of a PTA is equivalent variation. It is a money metric measure of change in utility at the initial prices. The economy-wide utility is a Cobb-Douglass function of household utility (which in turn is determined by non-homothetic CDE preferences), government consumption and savings. An alternative welfare measure would be real consumption. To make this a meaningful welfare indicator, the trade balance needs to be held constant in simulations, so that any change in real consumption does not result merely from changes from lending to or borrowing from overseas. The advantage of using real household consumption as an indicator of welfare change is that it is easier to interpret. In addition, for households which have little savings it is a very direct and precise measure of the change in their living standards. The disadvantage is that if policy change can result in significant changes in external accounts, fixing the trade balance will suppress adjustment to policy changes. This is particularly relevant when governments do not respond to changes in external balances arising from specific policy changes. The real consumption measure is also sensitive to the specification of income disposal at the macro level.

Based on the evidence provided by Gelshlar (1997) in his validation of the GTAP model, the magnitude of trade elasticities in the GTAP model is doubled in all simulations in the central scenarios (Table 1).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Elasticities of substitution used in the central scenario simulations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Between domestic products and imports</td>
</tr>
<tr>
<td>Agriculture</td>
<td>4.8</td>
</tr>
<tr>
<td>Manufactures</td>
<td>5.7</td>
</tr>
<tr>
<td>Services</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Source: Original GTAP elasticities multiplied by a factor of 2.

Sources of welfare gains and losses

In this section, we examine the sources of welfare gains and losses arising from a PTA. In examining the welfare implications of the NAFTA, the first issue one needs to be aware of is the point of time at which welfare changes are measured. We assume that the full effect of the NAFTA will work through by the 2005. To evaluate the welfare impact of the NAFTA in the year 2005, we first project the world economy to that year, thus creating a global equilibrium for that year as a benchmark against which the welfare impact of the NAFTA is compared.
Leaving aside policy changes, the projections essentially involve exogenously augmenting factor uses, GDP and population. The magnitude of these changes for our baseline projections is shown in Table 2. As exogenous GDP forecasts are imposed, economy-wide technological change variables in the model are endogenised to make up the gaps between GDP growth and factor accumulation. Alternatively, GDP growth can be endogenously determined if economy-wide technological change, along with factor uses, is exogenous. It should be noted, however, that GDP does not grow at the same rate across sectors in either approach, even though only economy-wide GDP growth or technological change is projected. Because of variations in factor intensity across sectors, different rates of accumulation among factors result in GDP growth differences among sectors—the Rybczynski effect. In addition, consumer preferences are non-homothetic, so the growth of demand for various products differs as income rises.

Table 2
Baseline projections of average annual growth of endowments, 1992–2005
(per cent per annum)

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Labour</th>
<th>Capital</th>
<th>GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>USC</td>
<td>0.9</td>
<td>0.8</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>Mexico</td>
<td>1.9</td>
<td>2.7</td>
<td>6.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Rest of the world</td>
<td>1.5</td>
<td>1.6</td>
<td>3.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>


In implementing the NAFTA, barriers to bilateral trade between the USC and Mexico are completely eliminated, while those between these two regions and the rest of the world are retained. All other types of trade-distorting policies, including production and export subsidies and taxes remain unchanged. In interpreting the NAFTA this way, we are aware that agricultural liberalisation in the NAFTA is much slower than liberalisation in manufactured goods and services. Our intention here is to examine a PTA in a general way and then turn to its particular characteristics. Thus, the agriculture issue in the NAFTA will be analysed subsequently.

With these assumptions our simulation results show that both the USC and Mexico benefit from the NAFTA whereas the rest of the world loses (first row, Table 3). The world as whole is better off marginally. Such results are not surprising, as many other studies have obtained similar results (Young and Huff 1997; Yang et al. 1998). In forming a PTA, the small entities tend to benefit most, while the larger entities either gain less or lose. The rest of the world is normally worse off from a PTA, as in our theoretical analysis.
In a standard neoclassical framework like GTAP, there are two sources of gains or losses arising from a PTA: changes in allocative efficiency and in the terms of trade. In the bottom two rows of Table 3, the aggregate welfare changes are decomposed into these two effects. The decomposition shows that the gain to the USC results entirely from improved allocative efficiency, while that to Mexico is predominantly from a favourable terms of trade effect. The change in the terms of trade alone would make the USC worse off.

The rest of the world suffers both an efficiency loss and an adverse terms of trade effect. The terms of trade effect, however, dominates. This supports Winters and Chang (1997) who argue that the welfare impact on third countries of a PTA works primarily through the terms of trade effect and that the change in their exports to the PTA is a poor indicator of the welfare effect on them.

While these results are consistent with our theoretical analysis earlier under the differentiated product framework, they do not support the conventional conclusion of some partial equilibrium studies that a small country (relative to the rest of the world) could suffer an adverse terms of trade effect in joining a PTA. The key factor missing in their analysis is the effect of reciprocal trade liberalisation in a PTA. It is true that for a small country (in our case, Mexico), imports become more expensive after joining a PTA as it loses tariff revenue from trade diversion (Table 4). However, it is also true that export prices will rise following the PTA, and that the rise in the export prices dominates the terms of trade effect. Not only Mexico’s terms of trade vis-à-vis the USC improves but also that relative to the rest of the world. In fact, in percentage terms, Mexico’s terms of trade vis-à-vis the rest of the world improves more than that vis-a-vis the USC. This result, of course, is largely due to the fact that Mexico is a much smaller trading partner for the rest of the world than for the USC. Its export prices improve as demand for its commodities by the rest of the world rises. On the other hand, Mexico has little impact on the prices of its imports from the rest of the world. Consistent with the overall terms of trade story, the bilateral terms of trade improvement for Mexico results primarily from increases in export prices. While the price of imports from the USC increase as a result of rising demand, the price of imports from the rest of the world declines slightly, re-enforcing the favourable terms of trade effect from increases in export prices.

Table 3  The welfare effects of the NAFTA, 2005 (US$ billion)

<table>
<thead>
<tr>
<th>Source: Simulations of the GTAP model.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equivalent variation</td>
</tr>
<tr>
<td>0.58</td>
</tr>
<tr>
<td>Allocative efficiency</td>
</tr>
<tr>
<td>Terms of trade</td>
</tr>
</tbody>
</table>

| Source: Simulations of the GTAP model. |
The overall deterioration of the terms of trade for the USC is entirely due to the unfavourable change in its terms of trade with the Mexico; its terms of trade vis-à-vis the rest of the world improves significantly. Here the story is the same as for Mexico. Not only does the price of exports to the rest of the world improve but also imports from the rest of the world become less expensive.

Table 4  
The terms of trade effect of the NAFTA, 2005 (per cent)

<table>
<thead>
<tr>
<th>Trade partner</th>
<th>USC</th>
<th>Mexico</th>
<th>ROW</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>-0.02</td>
<td>1.80</td>
<td>-0.05</td>
</tr>
<tr>
<td>Price of exportables</td>
<td>0.15</td>
<td>1.90</td>
<td>-0.04</td>
</tr>
<tr>
<td>Price of importables</td>
<td>0.17</td>
<td>0.09</td>
<td>0.01</td>
</tr>
<tr>
<td>USC</td>
<td>0.00</td>
<td>1.91</td>
<td>-0.19</td>
</tr>
<tr>
<td>Export price</td>
<td>0.16</td>
<td>2.07</td>
<td>-0.04</td>
</tr>
<tr>
<td>Import price</td>
<td>0.16</td>
<td>0.15</td>
<td>0.16</td>
</tr>
<tr>
<td>Mexico</td>
<td>-1.74</td>
<td>0.00</td>
<td>-2.36</td>
</tr>
<tr>
<td>Export price</td>
<td>0.16</td>
<td>3.63</td>
<td>-0.04</td>
</tr>
<tr>
<td>Import price</td>
<td>1.93</td>
<td>3.63</td>
<td>2.38</td>
</tr>
<tr>
<td>Rest of the world</td>
<td>0.19</td>
<td>2.52</td>
<td>-0.01</td>
</tr>
<tr>
<td>Export price</td>
<td>0.16</td>
<td>2.49</td>
<td>-0.04</td>
</tr>
<tr>
<td>Import price</td>
<td>-0.03</td>
<td>-0.03</td>
<td>-0.03</td>
</tr>
</tbody>
</table>

Source: Simulations of the GTAP model.

Changes in the terms of trade is globally a zero-sum game. Since the terms of trade for both Mexico and the USC improve, it is not surprising that the rest of the world loses substantially from the NAFTA. While the terms of trade loss constitutes the major part of the overall welfare loss for the rest of the world, the decline in allocative efficiency is nevertheless significant. In a partial equilibrium analysis, efficiency losses occur in the rest of the world when domestic production contracts as a result of the trade diversion effect of the PTA. In the general equilibrium analysis here, we assume that initial employment levels of factors of production are maintained, so that the level of economic efficiency depends entirely on how the resources are re-allocated following the PTA.

As bilateral trade between the USC and Mexico is liberalised, their agricultural and manufactured exports to the rest of the world decline. In the GTAP data base, there are no barriers to trade in services. Thus in the rest of the world resources move away from the services sector to agriculture and manufacturing where trade distortions are prevalent, not only in the form of tariffs but also in the form of production and export subsidies. This reallocation of resources makes the rest of the world economy less efficient.

A PTA typically offers differential treatment to certain commodities which are often regarded as politically sensitive to trade liberalisation. Agricultural commodities are most frequently given such special treatment—tariff reductions are either exempted or
discounted. Where they are not exempted, a longer grace period is permitted. Such is the case for the NAFTA. In the remaining part of this section, we explore the implications of excluding agriculture in the NAFTA. Agriculture is important not only because it is a highly distorted sector but also because the continuation of these distortions after trade liberalisation in other sectors leads to second-best outcomes for both liberalising and third countries.

The policy change simulated here is the same as in the previous section, except that tariffs on agricultural imports are not subject to elimination. The results show that the broad pattern of the welfare impact of the NAFTA obtained earlier is retained. That is, both the USC and Mexico gain, while the rest of the world loses (Table 5). In terms of the sources of the welfare impact, however, there are substantial differences. When agriculture is excluded from bilateral trade liberalisation, allocative efficiency in the USC declines, while the terms of trade improve—exactly opposite to the case where agriculture is included in trade liberalisation. Thus it is agricultural liberalisation that would lead to the deterioration of the terms of trade for the USC. This is a typical large country effect of trade liberalisation.

| Source: Simulations of the GTAP model. |

Table 5  
The welfare effects of the NAFTA excluding agriculture, 2005 ($ billion)

<table>
<thead>
<tr>
<th>Equivalent variation</th>
<th>USC</th>
<th>Mexico</th>
<th>ROW</th>
<th>World</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocative efficiency</td>
<td>-0.59</td>
<td>0.84</td>
<td>-2.15</td>
<td>-1.90</td>
</tr>
<tr>
<td>Terms of trade</td>
<td>1.13</td>
<td>1.74</td>
<td>-2.89</td>
<td>-0.02</td>
</tr>
</tbody>
</table>

The decline in USC allocative efficiency is largely a second-best outcome. There are several reasons for this outcome. When tariffs on manufactures in Mexico are eliminated, USC imports of manufactured commodities from Mexico increase. This occurs at the expense of imports from the rest of the world, leading to an efficiency loss which explains nearly 60 per cent of the total efficiency loss. In the terminology of Sinclair and Vines (1995), this is a violation of the optimal import sourcing condition. Second, demand for locally made manufactured goods declines slightly as a result of increased imports from Mexico, causing losses in consumer surplus and government taxes. Finally, USC service industries contract slightly following the NAFTA, leading to a sizeable loss in private consumption.

How robust are the results?

It is clear from the above analysis that the terms of trade effect is critical to the welfare outcomes of a PTA. In a model like GTAP, the terms of trade effect is essentially determined by two sets of elasticities of substitution: one between imports and domestically produced goods and the other between imported commodities from different sources of supply. In
this section, we test the sensitivity of the results reported in the previous section to these elasticities.

Obviously, there are almost infinite combinations of these elasticities. To test a large number of these combinations would be a daunting task even with the small dimension of the model we have chosen. Here we repeat our simulations in the previous section with the magnitude of the elasticities ranging from one half of the original GTAP elasticities to eight times. In each of the six experiments, all the elasticities are multiplied by the same proportion, thus the relative magnitude of the elasticities are maintained. This of course does not mean that the relative magnitudes of the GTAP elasticities are accurate; the test on variations in the relative magnitudes is not carried out here because the amount of computation it would entail would be enormous. The results of the six simulations with proportionate As can be seen from Figure 3, when the elasticities of substitution are small, the impact (either positive or negative) of the PTA tends to be small as well. As the elasticities increase, the impact becomes larger. For Mexico, this means the gains from the PTA increase with the elasticities. In contrast, the gains to the USC are steady until the elasticities are four times the original GTAP elasticities, then the gains turn into losses which increase with the elasticities. In the case of Mexico, both allocative efficiency and the terms of trade improve as the elasticities increase, whereas in the case of the USC, allocative efficiency improves, but the terms of trade deteriorate. This pattern of change in the terms of trade effect is observed not only in terms of the welfare effect as measured by equivalent variation, but also in terms of percentage change in the ratio of export to import prices (Table 6).

Table 6 The terms of trade effect of the NAFTA, 2005 (per cent)

<table>
<thead>
<tr>
<th>Multiplier of elasticities</th>
<th>1/2</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>USC</td>
<td>0.04</td>
<td>0.05</td>
<td>-0.02</td>
<td>-0.16</td>
<td>-0.41</td>
<td>-0.78</td>
</tr>
<tr>
<td>MEXICO</td>
<td>1.79</td>
<td>1.37</td>
<td>1.80</td>
<td>2.31</td>
<td>3.05</td>
<td>4.02</td>
</tr>
<tr>
<td>ROW</td>
<td>-0.05</td>
<td>-0.05</td>
<td>-0.05</td>
<td>-0.04</td>
<td>-0.04</td>
<td>-0.03</td>
</tr>
</tbody>
</table>

Source: Simulations of the GTAP model.
Figure 3  The impact of a comprehensive PTA, 2005

United States and Canada

Mexico

The rest of the world
Figure 4  The impact of a PTA excluding agriculture, 2005

United States and Canada

Mexico

Rest of the world
Why does the allocative efficiency effect move in the same direction for both regions while the terms of trade effect goes in opposite directions? As the elasticities of substitution increase, the scope for substitution between domestically produced products and imports increases in the USC, as in the other two regions. This allows more imports from Mexico, especially agricultural imports. As agricultural imports increase, USC consumers benefit, and domestic production declines. Because USC agriculture receives production subsidies, the reduction in production improves welfare. At the same time, manufactured goods and services are subject to output taxes. The expansion of the output of these two sectors also improves allocative efficiency. Partially offsetting these benefits are the welfare losses resulting from reduced consumption of domestically produced goods and increased exports of agricultural commodities. Since USC agricultural exports are subsidised, their expansion leads to an increased efficiency loss, instead of an efficiency gain. Allocative efficiency improves in Mexico for similar reasons. As the elasticities increase, both imports and exports increase, resulting in larger welfare benefits. These increased benefits are partially offset by the increased welfare losses resulting from greater reductions in the production of services and manufactured goods.

The divergence of the terms of trade effect between the USC and Mexico is related to country size. For Mexico, as the elasticities of substitution increase, demand for its products by the USC increases further, bidding up Mexico’s export prices, especially the prices of agricultural commodities. On the import side, the increased demand for USC products by Mexico has little impact on its import prices because of its small size relative to the USC. In contrast, increased demand for Mexican products by the USC as a result of increased elasticities of substitution leads to substantial increases in import prices. Meanwhile, the expansion of USC exports to Mexico pushes down prices, especially prices for agricultural commodities.
The results for the rest of the world are even more interesting. While the terms of trade effect improves all the way along as the elasticities increase, the allocative efficiency first deteriorates and then improves exponentially when the elasticities are larger than four times the original magnitude. This result is primarily determined by the changes in ROW imports of agricultural commodities from the USC. When the elasticities of substitution are about twice as large as the original GTAP elasticities, the ROW imports of agricultural commodities from the USC decline most. At that magnitude of elasticities, the ROW suffers the greatest allocative efficiency loss from the imports of agricultural commodities. This loss dominates the overall allocative efficiency outcome. As the elasticities of substitution increase, agricultural imports from the USC increase as well, and eventually increase by as much as 9 per cent when the elasticities are eight times the original GTAP magnitude. At the same time, imports of manufactured commodities from the USC and Mexico decline, leading to increasing welfare losses. However, this effect is increasingly dominated by even more rapid increases in allocative efficiency gains arising from increased agricultural imports.

The increases in the ROW imports of agricultural commodities from the USC result primarily from the increased competition from Mexican agriculture as the elasticities of substitution increase. As these elasticities increase, the NAFTA progressively depresses agricultural prices in the USC. This makes US agricultural commodities increasingly competitive in the ROW market. When the elasticities are sufficiently large (about six times the original GTAP magnitude), welfare gains from increased agricultural imports (plus the welfare gain from increased production of services) are able to fully offset the welfare losses arising from decreases in the imports of manufactures from the USC and Mexico.

The results for the PTA excluding agriculture are even more striking (Figure 4). Mexico maintains its broad pattern of welfare gains. Both allocative efficiency and the terms of trade improve, but allocative efficiency tends to improve more rapidly (from a small base) than the terms of trade, although the overall benefits are smaller without the liberalisation of agriculture. For the USC, both allocative efficiency and the terms of trade effect deteriorate continuously as the elasticities increase, although the latter does not decline to the same extent as in the scenario where agriculture is liberalised. The USC ends up losing more from a PTA excluding agriculture than one from including agriculture.

When agriculture is excluded from the NAFTA, the potential efficiency gain from this sector is lost. This potential gain increases as the elasticities of substitution increase. Although the imports of manufactured goods and services increase, they come exclusively from Mexico and at the expense of imports from the rest of the world. As a result, while there is an efficiency gain from the increased imports from Mexico, it is more than offset by the efficiency loss resulting from decreases in imports from the rest of the world. This loss becomes larger relative to the gain from increased imports from Mexico as the elasticities increase. That is, the sourcing of USC imports become increasingly suboptimal as the elasticities increase.
For the rest of the world, while the terms of trade effect hardly changes when the elasticities vary, the allocative efficiency gain declines rapidly as the elasticities increase. Allocative efficiency gains dominate the overall welfare outcome. In contrast with the scenario including agriculture where the rest of the world gains when the elasticities are eight times the original magnitude, the rest of the world loses substantially more when the elasticities increase. Instead of increasing with the elasticities of substitution, as is the case when agriculture is included in the NAFTA, agricultural imports from the USC decline with the increase in elasticities. This results in large welfare losses in the rest of the world. In addition, manufactured exports also fall more when the elasticities increase, thus further exacerbating the efficiency loss.

The changes in global welfare as the elasticities of substitution increase are shown in Figure 5. When agriculture is included in the NAFTA, global welfare improves continuously as the elasticities increase. In contrast, global welfare declines as the elasticities increase when agriculture is excluded. This demonstrates that a PTA excluding agriculture can lead to lower welfare for the world economy. The greater the demand response, the larger the global welfare loss becomes.

Concluding remarks

Partial equilibrium analysis of the welfare impact of PTAs in a homogenous product framework tends to miss several critical factors. The most important among them is the effect of a PTA on the exports of PTA member countries via reciprocal tariff reductions and the general equilibrium effects, including important second-best outcomes arising from exemptions of particular commodities from trade liberalisation. In a homogenous product framework, trade diversion is more likely to occur in a small country as imports from one source can perfectly substitute for those from another source. In a differentiated product model, substitution of imports from different sources is dampened, and a PTA is likely to increase the overall imports of member countries, and hence lead to trade creation. The terms of trade effect is crucial in determining the welfare outcome of a PTA, in either a homogenous product or differentiated product framework. While the size of country is important as has been long recognised, the change of export prices arising from reciprocal bilateral trade liberalisation is crucial in determining the direction of welfare effects of a PTA.

In this paper, we have used the NAFTA as a prototype of a PTA for the analysis of these issues within a general equilibrium model framework. The results show that when a PTA involves a large and a small country, the small one tends to gain, while the large one may or may not gain. The small country can gain both from the favourable terms of trade effect and improved allocative efficiency. Both effects have much to do with country size. A small country does not bid up the prices of imports from its large PTA partner, nor do its exports to the partner suffer much from depressed prices in the partner market. In fact, when the partner country liberalises its trade as part of a PTA agreement, the small country’s exports are likely to increase at higher prices. If the small country trades
intensively with its large partner, as is the case for Mexico in its trade with the USC, trade liberalisation in the partner country boosts imports and exports on a broad basis, resembling global trade liberalisation. This is the primary source of efficiency gain. These results confirm Schiff’s (1996) conclusion that small is beautiful.

In contrast, the large country tends to suffer a terms of trade loss, but its allocative efficiency may or may not improve. It is more likely to improve if trade liberalisation is broadly based. If exemptions are accorded to highly protected sectors, such as agriculture, then allocative efficiency is likely to decline. Without the terms of trade advantage, this could ultimately determine the overall welfare outcome of a PTA for the large country. This is because increased trade with a small partner is likely to cause suboptimal sourcing of imports. Depending on where the country’s comparative advantage lies, resources may move to sectors remaining protected.

The rest of the world is likely to be worse off from a PTA, and global welfare may or may not improve, as established in the literature. The potential loss for the rest of the world occurs primarily from an adverse terms of trade effect, but allocative efficiency can also decline significantly. This conclusion does not seem to change when certain sectors are excluded from a PTA.

In view of the importance of the terms of trade effect found both in this study and elsewhere, sensitivity tests were carried out on the elasticities of substitution among commodities. Contrary to the conventional wisdom, the tests show that for the large country, the typically adverse terms of trade effect does not decline as the elasticities increase; in fact, it may well be exacerbated as the demand response increases. Allocative efficiency, on the other hand, can improve as increases in the elasticities result in greater trade creation. However, if particular sectors such as agriculture are excluded from the PTA, both efficiency and terms of trade can deteriorate with larger elasticities.

While welfare increases for the small country as the elasticities increase, this can only occur for the rest of the world when the elasticities are very large. This, however, does not come from improvements in the ROW terms of trade, rather from improved allocative efficiency. This result is somewhat surprising. It occurs when increased trade within the PTA results in lower prices for some commodities, and these commodities are then exported to the rest of the world. If the commodities happen to be important and highly protected in the rest of the world, it is possible, albeit unlikely, that the overall efficiency gain dominates the terms of trade loss. Thus, the welfare outcome of a PTA for the rest of the world does seem to depend on the structure of its own protection as well as that in PTA member countries.
Notes

1 It can fall, however, if the increased imports from the partner country can wipe out all imports from the ROW. See Bhagwati and Panagariya (1997) for various scenarios when this occurs.
2 See Huff and Hertel (1996) for details of welfare decomposition in the GTAP model.
3 In 2005, Mexico is projected to account for 9 per cent of total USC exports and 1 per cent of ROW exports. On the import side, the USC accounts for 74 per cent of total Mexican imports and the rest of the world 26 per cent. These percentages are the baseline projections without the effect of the NAFTA.
4 This need not be precisely the case in an empirical model such as GTAP where there are margins of errors in data and computing.

References


Sinclair, P. and Vines, D., 1995 Bigger trade blocs need not entail more protection, University of Birmingham (mimeo.)


